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ABSTRACT

The basic hypothesis of this study was that among elementary school boys, those judged by their teachers to be hyperactive would have significantly more minor physical anomalies than those boys judged by their teachers to be non-hyperactive. A total of 46 hyperactive and 44 non-hyperactive children as rated by their teachers were the experimental and control groups. A total anomaly score and a weighted anomaly score were computed for each child. Results of the study include: (1) there was a significant mean difference in anomaly scores for males and females; (2) hyperactive behavior is associated with the presence of minor physical anomalies in boys, not girls; and (3) there was no difference in the anomaly score for Negroes and the anomaly score for Caucasians. (KJ)

HYPERACTIVITY AND MINOR PHYSICAL ANOMALIES IN ELEMENTARY SCHOOL CHILDREN

Mary F. Waldrop and Jacob D. Goering*

Hyperactive, impulsive and poorly controlled behavior in children is a major problem for parents, clinicians and teachers. It is also the topic of many research studies, several of these having differentiated the various behaviors that comprise the "hyperactive syndrome."[5,4] Other studies have reported on the stability of this kind of behavior during childhood.[2,3] Little attention has been paid, however, to the possible etiologies of this syndrome. Weiss and his colleagues[8] have pointed out that it is usually taken as axiomatic that hyperactivity results from some sort of minimal brain damage even though there is a conspicuous absence of the kind of neurological and electroencephalographic signs which would substantiate such a diagnosis.

Our own past research has taken a somewhat different approach to hyperactivity in that we have been searching for evidence of possible congenital contributors to uncontrolled, fast moving behavior. We found

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that an index to minor physical anomalies is related to the indicidence of hyperactive behavior in young boys and girls.[6] In our first study we found that normal preschool children with multiple minor physical anomalies (which either are present at birth or are a part of their developmental pattern) tended to be frenetic, impatient, and intractable in a nursery school setting. We interpreted the relation of these physical anomalies to hyperactive behavior as evidence for congenital contributors to this behavior. The same factors operating in the first weeks of pregnancy probably influenced the occurrence both of these morphological aberrations and the predisposition for impulsive, fast moving behavior. When we saw hyperactive play behavior we frequently found that these children also had such physical anomalies as head circumference out of normal range, epicanthus, widely spaced eyes, curved fifth finger, no ear lobes, and wide gap between first and second toes. See Table 1.

The list of the minor physical anomalies used in our research was originally used by Goldfarb and Botstein[1] to differentiate schizophrenic children from normal children. These minor physical anomalies, which as a group are typically associated with Down's Syndrome and with other major congenital defects, have been thought to result from chromosomal irregularities or some kind of insult affecting embryological development. For example, we have found that children with congenital speech and hearing problems, have on the average about twice as many of the minor anomalies than our normal preschool children.[7]

When we attempted to replicate the relation of the anomalies to hyperactive behavior on a second sample of two-and-a-half-year-olds attending the same research nursery school we found again that boys with high anomaly scores were likely to be hyperactive.[7] The relation did not replicate, however, for girls. In fact, in this second sample, the girls with more than an average number of anomalies tended to be inhibited and fearful. It is important to note that high anomaly children of both sexes seemed to have trouble with impulse control, too much for girls and too little for boys.

A follow-up study five years later of the same children who had attended our research nursery school and who had been the subjects for our original study, showed that the anomaly score tended to be stable over the five years. Also, children with high anomaly scores still were more hyperactive in a free play situation than children with fewer anomalies.[7]

The important thing to keep in mind is that in our past studies the cumulative incidence of these congenital anomalies was consistently related to hyperactive play behavior in what might be considered small selected samples of children and relatively circumscribed samples of behavior.

We felt the need for expanding our explorations to a larger, more heterogenous population. We also were interested in seeing if the concept of "hyperactivity" in the school situation related to the anomaly score in the same way as hyperactive play behavior had related to the anomaly score in the nursery school setting. Too, we wanted an opportunity to assess the anomalies completely independently of the assessment of hyperactivity. Although presumably these anomalies are either present or absent, there is a degree of judgment called for, and a knowledge of both the child and the expected results could create some bias on the part of the examiner. This source of bias was controlled in some, but not all of our previous studies.

HYPOTHESES

Based on the above findings, it would be expected that, among elementary school boys, those judged by their teachers to be hyperactive would have significantly more minor physical anomalies than those boys judged by their teachers to be non-hyperactive. In addition, it would be expected that among the hyperactive boys, those judged to be the most hyperactive would have significantly more minor physical anomalies than would the boys judged to be least hyperactive. Since we had no clear indication as to whether girls with high anomaly scores would or would not tend to be among the hyperactives, we were eager to see what the results would be but were unable to make predictions.

SUBJECTS AND PROCEDURES

The sample for this study was drawn from an elementary school with an enrollment of approximately 775 pupils in a city with a total population of about 23,000. The community is relatively stable. The principal had been at this same school for 10 years and consequently knew all the children rather well.

At a meeting with the faculty, without mentioning the hypotheses to be tested, I (the first author) asked each teacher to list the three children in her class whom she judged to be most hyperactive. These made up our experimental group. On a separate card each teacher was asked to list three additional children who, in her opinion, would fall in the normal range of behavior being neither hyperactive nor lethargic. These made up our control group. We found that the teachers had little difficulty in identifying the most hyperactive children in their classrooms. Children who are least able to "sit still and pay attention," being incessantly "on the move," are generally quite easily distinguished in classroom situations. Teachers know those children who are most fatiguing to them. The principal added two more names to the hyperactive list, and then ranked the entire list of designated hyperactives in order of severity. On the day we examined the children for anomalies, some from the experimental group and some from the control group were absent, resulting in a total of 46 hyperactive children, 34 males and 12 females, and a total of 44 non-hyperactive children, 18 males and 26 females.

Using the same scoring procedure we had used in our past studies, we computed for each child a total anomaly score and a weighted anomaly score. When we found that the weighted score correlated .86 with the total score, we used only the weighted score in analyzing these data.

Having fine electric hair had been considered an anomaly in our previous studies but was eliminated in this study because some of the subjects were Negroes. Of all the anomalies observed in this study, only the measure used to gauge hyperteliorism (intercanthal distance) showed a significant difference of means ($\underline{t}$ = 2.54) between Negroes and and Caucasians. (For Negroes, $\overline{X}$ = 3.31 and σ = .29; for Caucasians, $\overline{X}$ = 3.13, σ = .27.) In view of these results, .2 cm. was subtracted from each Negro child's measure of intercanthal distance in order to equate the scores of hyperteliorism for racial differences.

As the examiner in this study, I had no knowledge of whether or not a child was hyperactive nor had I ever seen any of the children before they were brought to the examining room. All the children were seen in random order at about five-minute intervals. In scoring the presence of these minor physical anomalies I had established adequate reliability in two previous studies (r = .70 and r = .96).

Since Negroes constituted 24.5% of the total population in this elementary school, 30% of our hyperactive sample, and 18% of our non-hyperactive sample, t tests were run to see if there were any significant racial differences in the mean number of anomalies. Because no significant differences were found (t = .13) there is no racial breakdown in the analysis of these data. (For Negroes, N = 22, $\bar{X}$ = 4.14, σ = 2.42; for Caucasions, N = 68, $\bar{X}$ = 4.22, σ = 2.34.) To test the hypothesis that within a group of hyperactive children, the more hyperactive the child the more minor physical anomalies he will have, a rank order correlation was run between the children's ranks on hyperactivity and their ranks on weighted anomaly scores.

RESULTS

In checking for sex differences, we found there was a significant mean difference in anomaly scores for males and females, t = 3.16, $p < .01$. For males, N = 52, $\bar{X}$ = 4.69, σ = 2.38; for females, N = 38, $\bar{X}$ = 3.53, σ = 2.16.)

Insert Table 2 about here

As a total group the hyperactive children had significantly more anomalies than did the children who were not hyperactive. Table 2 shows, however, that these significant differences were true only for the males. The table also shows that out of the 46 hyperactive children, 34 were male and only 12 were female or about three fourths of the hyperactives were male.

The principal of the school had rank ordered all the children selected as hyperactive. A rank order correlation for males (*rho* = .39, *p* < .05) showed that the more hyperactive a boy was, the more minor physical anomalies he was likely to have.

DISCUSSION

For the boys in this sample we have shown that hyperactive behavior is associated with the presence of minor physical anomalies. As in one of our previous studies, this relation was not true for girls. This sex difference is probably related to there being three times as many boys as girls chosen as being hyperactive. This is quite consistent with others who report very few females among the clinically hyperactive,[9] and with there being almost no females in the congenitally deviant sample we studied. We are led to consider the possibility that genetic and teratogenetic stresses affect males and females differently in regard to their inability to inhibit motor responses.

We now see that the relation of hyperactivity to physical characteristics is true for boys from a large elementary school as well as for boys from the smaller and relatively more select samples we studied earlier. This enhances the meaning and generality of the findings. Also of importance is the fact that in this study the assessment of hyperactivity and the assessment of the anomalies were completely independent. Children were selected as being hyperactive or non-hyperactive by teachers who had no knowledge of the hypotheses being tested, but who did have intimate knowledge about the child's classroom behavior during at least one school year. The person checking the children for the presence of the minor anomalies had no previous knowledge of any of the children, and had very little chance, if any, of seeing spontaneous behavior on the part of any child being examined since each child was visible to her for only a few minutes.

From the data obtained we can conclude that teachers in this elementary school thought there was no difference in the proportional representation among the hyperactives between Negroes and Caucasians. Also of significance is the finding that after adjustment for racial differences in hyperteliorism there was no difference in the anomaly score for Negroes and the anomaly score for Caucasians.

Obviously, knowledge that hyperactive behavior seems to be linked to some congenital variables will do nothing to diminish the amount of hyperactivity. Yet it does seem reasonable to think that knowing that a child may be unable to exert wished for controls might reduce emotions frequently associated with hyperactivity, such as hostility, blame, and self-hate. The knowledge that the accumulative incidence of certain minor physical anomalies is associated with hyperactivity for boys provides us with the tool to identify a potentially hyperactive boy before his behavior becomes stressful to everyone around him. If our subsequent research on these high anomaly children "identified at birth" continues to show these relations to hyperactivity (from our longitudinal work), clinically it might be extremely valuable to make the anomaly assessment a routine pediatric procedure very early in life. Parents and professionals alike could be made alert to potential behavior problems. Appropriate therapy could be instituted before parents and children have suffered several years of agony and disruption.

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Table 1

List of Anomalies and Scoring Weights

Anomaly	Weight
Head	
Two or more hair whorls	0
Circumference out of normal range:	
For each age level, > 1.5 σ	2
> 1.0 σ $\leqslant$ 1.5 σ	1
Eyes	
Epicanthus:	
Where upper and lower lids join the nose, point of union is:	
Deeply covered	2
Partly covered	1
Hypertelorism:	
Approximate distance between tear ducts:	
For 6- and 7-year-olds, = 3.2 cm.	1
$\geqslant$ 3.3 cm.	2
For 8- and 9-year-olds, = 3.3 cm.	1
$\leqslant$ 3.4 cm.	2
For 10-, 11-, and 12-year-olds, = 3.4 cm.	1
$\geqslant$ 3.5 cm.	2

Table 1 (Continued)

List of Anomalies and Scoring Weights

Anomaly	Weight
Ears	
Low seated:	
Top juncture of ear is below line extended from nose bridge through outer corner of eye by ≤ .5 cm.	1
< .5 cm.	2
Adherent lobes:	
Lower edges of ears extend:	
Upward and back toward crown of head	2
Straight back toward rear of neck	1
Malformed ears	1
Asymmetrical ears	1
Soft and pliable ears	0
Mouth	
High palate:	
Roof of mouth:	
Definitely steepled	2
Flat and narrow at the top	1
Furrowed tongue (one with deep ridges)	1
Smooth-rough spots on tongue	0

Table 1 (Continued)

List of Anomalies and Scoring Weights

Anomaly	Weight
Hands	
Fifth finger:	
Markedly curved inward toward other fingers	2
Slightly curved inward toward other fingers	1
Single transverse palmar crease	1
Feet	
Third toe:	
Definitely longer than second toe	2
Appears equal in length to second toe	1
Partial syndactylia of two middle toes	1
Gap between first and second toe (approximately $\geq \frac{1}{4}$ inch)	1

Table 2

Mean and Mean Differences in Anomaly Scores

	Hyperactive			Non-hyperactive			*t*	*P*	Pt. Biserial *r*
	N	$\overline{X}$	σ	N	$\overline{X}$	σ			
Males	34	5.59	2.03	18	3.00	2.06	4.20	<.001	.50
Females	12	3.50	2.22	26	3.54	2.13	.05		